

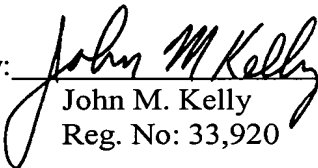
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Respectfully submitted,

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Attachments: Substitute Specification  
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**EXHIBIT I**

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

5. (Amended) The LCD of claim 4, wherein each of the [odd numbered] signal lines [and the even numbered signal lines are curved in their crossing portions.] includes protrusions for the first and second electrostatic protecting circuits.



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original document : C:\DOCUME~1\CSAUND~1\LOCALS~1\TEMP\DC-#76576-V1-8733\_424\_00\_- ORIGINAL\_SPEC\_FROM\_CLIENT.DOC

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Deletions appear as Overstrike text surrounded by {}

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## LIQUID CRYSTAL DISPLAY

### [Cross Reference]

[0001] This application claims the benefit of Korean Patent Application No. 2000 19354, filed April 12, 2000, under 35 U.S.C. §119, the entirety of which is hereby incorporated by reference.]

### BACKGROUND OF THE INVENTION

#### Field of the Invention

~~{The present}~~[[0002] This] invention relates to ~~{a}~~ liquid crystal ~~{display}~~ [displays] (LCD), and more particularly, to an LCD ~~{in which}~~ [having] an electrostatic ~~{protecting circuit is arranged using a narrow signal line interval}~~ [protection circuit].

#### Discussion of the Related Art

~~{Generally, an LCD}~~[[0003] Generally, a liquid crystal display is a complex device that] includes a liquid crystal panel, a light source, and ~~{a}~~ driving ~~{circuit}~~ }[circuitry].

[0004]] The liquid crystal panel [itself] includes upper and lower transparent substrates~~{,}~~ and ~~{a}~~ [an interposed] liquid crystal layer[. On the upper transparent substrate are a system] ~~{in which a liquid crystal is injected between the upper and lower transparent substrates}~~.

~~A common}~~ electrode, a black matrix layer, and a color filter layer ~~{are formed on the upper transparent substrate. A plurality of gate lines are arranged on}~~[. On] the lower transparent substrate ~~{in one direction at constant intervals. A plurality of data lines are arranged at constant intervals in a vertical direction to the gate lines, so that an LCD array~~

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~~is formed in crossing points of~~ [are a plurality of equally spaced gate lines that are arranged along one direction, and a plurality of equally spaced data lines that are arranged perpendicular to the gate lines. Thus there is a plurality of crossing points where] the gate lines and the data lines~~{. In the LCD array, a pixel region is formed in a space between the respective}~~ [cross.

[0005] Within an LCD panel is an array of pixel regions defined by the spaces between the crossing] gate and data lines. A pixel electrode and a thin film transistor [(TFT)] are arranged in each pixel region. ~~{A}~~ [The TFT] gate ~~{electrode is connected}~~ [electrodes connects] to the gate lines, ~~{a}~~ [the TFT] source ~~{electrode is connected}~~ [electrodes connect] to the data lines, and ~~{a pixel electrode is connected to a drain electrode, so that the thin film transistor is}~~ [the TFT drain electrodes connect to the pixel electrodes. The gate and data lines are electrically connected to the driving circuitry. In operation, the thin film transistors are] selectively turned on ~~{in accordance with a signal}~~ [by gate signals] applied to the gate lines. ~~{Thus, a data signal of the data lines is applied to the pixel electrode. The respective gate and data lines are electrically connected to a driving circuit.}~~ [Furthermore, data signals are selectively applied to the data lines. The result is that the various TFTs apply signals to their electrodes so as to produce a desired image. ]

~~{In the aforementioned LCD, since static electricity occurs during process steps or test, it is likely that devices of the LCD array are destroyed and damaged if the}~~ [[0006]

Often, static electricity is produced during the processing and/or testing of the LCD panels. When this] static electricity is applied to the gate [or data lines damage or destruction of the LCD panel can occur. One method of protecting

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LCD arrays from static electricity uses common electrodes inserted] ~~{lines or the data lines.~~

~~To protect the LCD array from the static electricity, the common electrode is formed}~~ between the driving ~~{circuit and the LCD array in a vertical direction to the gate and data lines, and an}~~ [circuitry and the LCD array, with the common electrodes extending generally perpendicular to the gate lines and/or to the data lines. Then,] electrostatic protecting ~~{circuit is formed in either a crossing portion of the }~~ [circuits, such as varistors, diodes, zener diodes, unidirectional or bi-directional transient voltage suppressors, or bi-directional voltage triggered switches, are formed at the crossings of the gate and/or] data lines and the common ~~{electrode or a crossing portion of the gate lines and}~~ [electrodes. By using such electrostatic protecting circuits the potential of] the common electrode [is applied to the gate and/or]~~{.~~

~~If the electrostatic protecting circuit is formed as above, equivalent potential to the common electrode is formed in the gate lines and the}~~ data lines by the electrostatic protecting circuit [as required to protect the LCD panel]. Accordingly, ~~{even if the}~~ static electricity ~~{is}~~ applied to the gate lines or [to] the data lines~~{, it does not affect the devices of the LCD array.~~

~~}~~ [does little or no damage.

[0007]] A related art LCD ~~{provided with the aforementioned}~~ [having an] electrostatic protecting circuit will be described with reference to the [schematic view of Fig. 1] ~~{accompanying drawings.~~

~~Fig. 1 is a schematic view of a related LCD provided with an electrostatic protecting circuit}. {~~

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~~}In the related art LCD {, since a pixel size is greater than}~~ the electrostatic protecting ~~{circuit, the electrostatic protecting circuit is}~~ **[circuits are]** arranged in parallel. **[A]** ~~{As shown in Fig. 1, in a state that a}~~ common electrode 4 ~~{is arranged}~~ **[extends]** between a driving circuit 1 and an LCD array 2 ~~{in a vertical direction to data lines 3}~~ **[and perpendicular to the data ]** or gate lines~~{, an}~~ **[3. An]** electrostatic protecting circuit 5 is ~~{arranged in one direction to correspond to portions, one to one, between the respective data lines 3 in crossing portions}~~ **[located near each crossing ]** of the common electrode 4 and the **[lines 3. Further, as shown, each line 3 extends]** ~~{data lines 3.~~

~~The respective data line 3 or the respective gate line is formed}~~ in a straight line between the driving circuit 1 and the LCD array 2.

~~{However}~~**[[0008]** While generally successful], the related art LCD ~~{provided with}~~ **[shown in Fig. 1 has a problem. Since]** the electrostatic protecting **[circuits are located near the crossings of the common electrode 4 and the lines 3, it is very difficult to physically locate]** ~~{circuit has several problems.~~

~~Since}~~ the electrostatic protecting ~~{circuit is arranged between the respective data lines in the crossing portion of the data line and the common electrode, it is difficult to arrange}~~ **[circuits 5 if the lines 3 are closely spaced, as can happen in high resolution LCDs, or if]** the electrostatic protecting ~~{circuit if the pixel size is smaller than the}~~ **[circuits are relatively large. Thus, new approaches to incorporating]** electrostatic protecting **[circuits would be beneficial]** ~~{circuit.~~

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~~In other words, since a space is narrow between the data lines in the LCD of high resolution, it is difficult to arrange the electrostatic protecting circuit therein. The LCD of high resolution cannot be obtained due to the electrostatic protecting circuit}.~~

### **SUMMARY OF THE INVENTION**

**[[0009]]** Accordingly, the present invention is directed to an LCD that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

**[[0010]]** An object of the present invention is to provide an LCD in which the ~~{position}~~ **[locations]** of ~~{an}~~ **[the]** electrostatic protecting ~~{circuit is changed or signal lines (data lines or gate lines) have modified shapes to obtain high resolution. }~~ **[circuits enable closely spaced signal lines.**

**[0011]** Another object of the present invention is to provide an LCD in which the signal lines are modified to enable closely spaced signal lines.

**[0012]** Another object of the present invention is to provide a high resolution LCD having electrostatic protecting circuits.

**[0013]** Yet another object of the present invention is to provide an LCD having relatively large electrostatic protecting circuits.

**[0014]** Another object of the present invention is to provide an LCD having relatively small pixels.

**[0015]]** Additional features and advantages of the invention will be set forth in the ~~{description which}~~ **[descriptions that]** follows, and in part will be apparent from ~~{the description}~~ **[those descriptions]**, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the



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scheme particularly pointed out in the written description and claims hereof[,], as well as [shown in] the appended drawings.

[[0016]] To achieve these and other advantages and in ~~{accordance}~~ [accord] with ~~{the}~~ [a] purpose of the present invention, as embodied and broadly described, an LCD according to the present invention includes a plurality of signal lines ~~{formed at constant intervals}~~, a common electrode ~~{arranged in a vertical direction}~~ [that extends generally perpendicular] to the signal lines, a plurality of first electrostatic protecting circuits respectively ~~{arranged at}~~ [located on] one side of the common electrode ~~{between adjacent first and second signal lines in pairs to be connected with the first signal lines of the respective pairs and the common electrode}~~ [and between adjacent signal lines], and a plurality of second electrostatic protecting circuits arranged ~~{at}~~ [on] the other side of the common electrode ~~{to be connected with the second signal lines of the respective pairs and}~~ [and between adjacent signal lines, wherein each electrostatic protecting circuit connects between] the common electrode [an a signal line. Beneficially, and as required, the adjacent signal lines include protrusions, which may be beveled or curved, that enable the electrostatic protecting circuits to be located between the signal lines.

[0017]]{

} To further achieve these and other advantages and in accordance with the purpose of the present invention, an LCD according to the present invention includes a plurality of signal lines ~~{formed at constant intervals}~~, first and second common electrodes arranged ~~{at constant intervals in a vertical direction}~~ [perpendicular] to the signal lines{,} [and between driving circuitry and an LCD array, and] a plurality of

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~~{first and second}~~ electrostatic protecting circuits arranged ~~{at both sides of the first common electrode between first and second signal lines of odd numbered pairs in adjacent first and second signal lines in pairs to be respectively connected with a pair of the first signal line and the first common electrode and a pair of the second signal line and the first common electrode, and a plurality of third and fourth}~~ [on opposite sides of the common electrodes and between the signal lines. Each electrostatic protecting circuit connects between a signal line and one of the common electrodes. Beneficially, the signal lines protrude as required to enable the ]electrostatic protecting circuits ~~{arranged at both sides of the second common electrode between the first and second signal lines of even numbered pairs to be respectively connected with a pair of the first signal line and the second}~~ [to be located between the signal lines. Also beneficially, the position of the electrostatic protecting circuits alternate, with one electrostatic protecting circuit being adjacent a first ]common electrode and ~~{a pair of the second signal line and}~~ [any neighboring electrostatic protecting circuits being adjacent] the second common electrode.

[[0018]] To further achieve these and other advantages and in accordance with the purpose of the present invention, an LCD according to the present invention includes ~~{a plurality}~~ [sets of pairs] of signal lines ~~{formed at constant intervals, a}~~ [, first and second] common ~~{electrode}~~ [electrodes] arranged ~~{in a vertical direction}~~ [perpendicular] to the signal lines~~{,}~~ [and between driving circuitry and an LCD array, and] a plurality of ~~{first}~~ electrostatic protecting circuits ~~{connected with odd numbered signal lines and the common electrode at one side of the common electrode, and a plurality of second}~~ [. The] electrostatic protecting circuits ~~{connected with even~~

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~~numbered signal lines and the common electrode at the other side of the common electrode, wherein the respective signal lines adjacent to the first and second }~~**[are alternatingly located adjacent the first common electrode and then adjacent the second common electrode. An electrostatic protecting circuit connects between the first common electrode and a first signal line of the pair of signal lines of a set, while a neighboring electrostatic protecting circuit connects between the second common electrode and the other signal line of the set. Beneficially, and as required, the signal lines includes protruding portions that enable the]**~~electrostatic protecting circuits {are curved.~~

**}[to be located between the signal lines of a set.**

**[0019]]** It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory **[only]** and are intended to provide further explanation of the invention as claimed.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[[0020]] The invention will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

[[0021]] Fig. 1 is a schematic view of a related art LCD ~~{provided with an}~~ **[having]** electrostatic protecting ~~{circuit;~~

~~}~~**[circuits;**

[0022]] Fig. 2 is a schematic view of an LCD ~~{provided with an}~~ **[having]** electrostatic protecting ~~{circuit according to the}~~ **[circuits that is in accord with a]** first embodiment of the present invention;

[[0023]] Fig. 3 is a schematic view of an LCD ~~{provided with an}~~ **[having]** electrostatic protecting ~~{circuit according to the}~~ **[circuits that is in accord with a]** second embodiment of the present invention;

[[0024]] Fig. 4 is a schematic view of an LCD ~~{provided with an}~~ **[having]** electrostatic protecting ~~{circuit according to the}~~ **[circuits that is in accord with a]** third embodiment of the present invention;

[[0025]] Fig. 5 is a schematic view of an LCD ~~{provided with an}~~ **[having]** electrostatic protecting ~~{circuit according to the}~~ **[circuits that is in accord with a]** fourth embodiment of the present invention; and

[[0026]] Fig. 6 is a schematic view of an LCD ~~{provided with an}~~ **[having]** electrostatic protecting ~~{circuit according to the}~~ **[circuits that is in accord with a]** fifth embodiment of the present invention.

**DETAILED DESCRIPTION OF THE ~~{PREFERRED}~~ [ILLUSTRATED]**

**EMBODIMENTS**

[[0027]] Reference will now be made in detail to the {preferred} [illustrated] embodiments of the present invention, examples of which are {illustrated} [shown] in the accompanying drawings.

~~{Fig. 2 is a schematic view of an LCD provided with an electrostatic protecting circuit according to the first embodiment of the present invention.}~~

~~As shown in Fig. 2, in a state that a common electrode 4 is formed in a vertical direction to respective signal lines 3a and 3b (data lines or gate lines) between a driving circuit 1 and an LCD array 2, adjacent signal lines 3a and 3b are arranged in pairs and electrostatic protecting circuits 5a and 5b are arranged at both sides of the common electrode 4 between the respective signal lines 3a and 3b. The first electrostatic protecting circuit 5a is connected with the first signal lines 3a of the respective pairs and the common electrode 4 while the second electrostatic protecting circuit 5b is connected with the second signal lines 3b of the respective pairs and the common electrode 4. At this time, the respective signal lines 3a and 3b are not curved.~~

~~The LCD constructed as above can reduce a space between the whole signal lines.~~

~~Meanwhile, Fig. 3 is a schematic view of an LCD provided with an electrostatic protecting circuit according to the second embodiment of the present invention.~~

~~In the LCD according to the second embodiment of the present invention, first and second common electrodes 4a and 4b are arranged. A first electrostatic protecting circuit 5a is connected between an odd numbered signal line 3a and the~~

~~first common electrode 4a while a second electrostatic protecting circuit 5b is connected between an even numbered signal line 3b and the second common electrode 4b.~~

~~At this time, the electrostatic protecting circuits 5a and 5b are formed at both sides around the first and second common electrodes 4a and 4b. That is, the first electrostatic protecting circuit 5a is connected with the first signal line 3a and the first common electrode 4a while the second electrostatic protecting circuit 5b is connected with the second signal line 3b and the second common electrode 4b in a direction opposite to the first common electrode 4a.~~

~~Fig. 4 is a schematic view of an LCD provided with an electrostatic protecting circuit according to the third embodiment of the present invention.~~

~~In the LCD according to the third embodiment of the present invention, a common electrode 4 is formed between a driving circuit 1 and an LCD array 2 in a vertical direction to a plurality of signal lines 3 (data lines or gate lines), and an electrostatic protecting circuit 5a or 5b is arranged between the respective signal lines. At this time, the first electrostatic protecting circuit 5a connected with an odd numbered signal line 3a is arranged toward the driving circuit 1 around the common electrode 4 while the second electrostatic protecting circuit 5b connected with an even numbered signal line 3b is arranged toward the LCD array 2 around the common electrode 4.~~

~~The signal lines are curved in portions where the first and second electrostatic protecting circuits 5a and 5b are arranged, so that a space where the electrostatic protecting circuits will be arranged can be obtained. In other words, the~~

~~odd numbered signal line and the even numbered signal line are curved in their crossing portion to obtain a space where the electrostatic protecting circuits will be arranged.~~

~~Fig. 5 is a schematic view of an LCD provided with an electrostatic protecting circuit according to the fourth embodiment of the present invention.~~

~~In the LCD according to the fourth embodiment of the present invention, first and second common electrodes 4a and 4b are arranged between a driving circuit 1 and an LCD array 2 in a vertical direction to a plurality of signal lines 3a and 3b (data lines or gate lines). Adjacent signal lines 3a and 3b are arranged in pairs and an electrostatic protecting circuit 5 is arranged at both sides of the first common electrode 4a between odd numbered signal lines 3a and 3b. The electrostatic protecting circuit 5 is also arranged at both sides of the second common electrode 4b between even numbered signal lines 3a and 3b. At this time, to obtain a space in a portion where the electrostatic protecting circuit 5 is arranged, the signal lines 3a and 3b are curved around the electrostatic protecting circuit 5.~~

~~The electrostatic protecting circuit 5 connected with the first common electrode 4a and the electrostatic protecting circuit 5 connected with the second common electrode 4b are not arranged on the same line but arranged to cross each other.~~

~~Fig. 6 is a schematic view of an LCD provided with an electrostatic protecting circuit according to the fifth embodiment of the present invention.~~

~~In the LCD according to the fifth embodiment of the present invention, first, second, third and fourth common electrodes 4a, 4b, 4c and 4d are arranged between~~

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~~a driving circuit 1 and an LCD array 2 in a vertical direction to a plurality of signal lines 3a and 3b (data lines or gate lines). At this time, the first common electrode 4a is adjacent to the second common electrode 4b while the third common electrode 4c is adjacent to the fourth common electrode 4d. The first and second common electrodes are spaced apart from the third and fourth common electrodes.~~

~~Adjacent signal lines 3a and 3b are arranged in pairs and an electrostatic protecting circuit 5 is arranged at both sides around the first and second common electrodes 4a and 4b between odd numbered signal lines 3a and 3b. The electrostatic protecting circuit 5 is also arranged at both sides of the third and fourth common electrodes 4c and 4d between even numbered signal lines 3a and 3b. The signal lines 3a and 3b are curved to obtain a space in a portion where the electrostatic protecting circuit is arranged. That is, the odd numbered signal line and the even numbered signal line are not curved on the same line but curved to cross each other.~~

~~As aforementioned, the LCD according to the present invention has the following advantages.~~

~~Since the electrostatic protecting circuit is arranged at both sides of the common electrode line, or the signal lines are curved to obtain a sufficient space in a portion where the electrostatic protecting circuit is arranged, a narrow space between the signal lines can effectively be used.~~

~~In addition, since the electrostatic protecting circuit is arranged between the narrow signal lines, the LCD of high resolution can be obtained.~~

~~}}[0028] Fig. 2 is a schematic view of an LCD having electrostatic protecting circuits that is in accord with a first embodiment of the present invention.~~



As shown, a common electrode 4 is formed perpendicular to a plurality of sets of signal lines 3a and 3b, which may be data lines and/or gate lines. The common electrode runs between a driving circuit 1 and an LCD array 2. The signal lines 3a and 3b of a set are adjacent one another. Furthermore, pairs of electrostatic protecting circuits 5a and 5b are arranged such that the common electrode 4 runs between them and such that the electrostatic protecting circuits are adjacent the signal lines 3a and 3b. A first electrostatic protecting circuit 5a connects between an associated first signal line 3a and the common electrode 4, while the second electrostatic protecting circuit 5b connects between an associated second signal line 3b and the common electrode 4. In this embodiment the signal lines 3a and 3b are straight. An LCD constructed according to Fig. 2 enables a reduction in the gap between the signal lines. Beneficially, the signal lines that leave the driving circuit 1 and that enter the LCD array 2 are evenly spaced.

[0029] Fig. 3 is a schematic view of an LCD having electrostatic protecting circuits that is in accord with a second embodiment of the present invention. As shown in Fig. 3, parallel first and second common electrodes 4a and 4b are arranged adjacent one another and generally perpendicular to sets of signal lines 3a and 3b. The first and second common electrodes 4a and 4b are also disposed between a driving circuit 1 and an LCD array 2. A first electrostatic protecting circuit 5a connects between a signal line 3a and the first common electrode 4a, while a second electrostatic protecting circuit 5b connects between a signal line 3b and the second common electrode 4b. As shown, the electrostatic protecting circuits 5a and 5b are alternately located adjacent the first and second common electrodes 4a and

4b, respectively. That is, a first electrostatic protecting circuit 5a, which connects between the first signal line 3a and the first common electrode 4a, is on the side of the first common electrode that is opposite the second common electrode. Furthermore, the second electrostatic protecting circuit 5b, which connects between the second signal line 3b and the second common electrode 4b, is on the side of the second common electrode that is opposite the first common electrode. Beneficially, the signal lines that leave the driving circuit 1 and that enter the LCD array 2 are evenly spaced.

[0030] As shown in Fig. 4, a plurality of first electrostatic protecting circuits 5a are positioned at one side of the common electrode 4, a plurality of second electrostatic protecting circuits 5b are positioned at opposite side of the common electrode, and each of the first electrostatic protecting circuits 5a and each of the second electrostatic protecting circuits 5b are positioned at opposite sides of the signal line 3b. Each of the first electrostatic protecting circuits 5a connects between the signal line 5a and the common line 4, and each of the second electrostatic protecting circuits 5b connects between the signal line 5b and the common line 4.

[0031] Fig. 4 is a schematic view of an LCD having electrostatic protecting circuits that is in accord with a third embodiment of the present invention. As shown in Fig. 4, a common electrode 4 is disposed between a driving circuit 1 and an LCD array 2. A plurality of signal lines, designated as 3a and 3b, which could be data lines and/or gate lines, extend between a driving circuit 1 and an LCD array 2. Furthermore, electrostatic protecting circuits 5a and 5b are positioned between the respective signal lines 3a and 3b. The electrostatic protecting

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circuits 5a connect between the signal lines 3a and the common electrode 4, while the electrostatic protecting circuits 5b connect between the signal lines 3b and the common electrode 4.

[0032] Still referring to Fig. 4, the signal lines 3a and 3b include protrusions, which may have beveled or curved portions, for the first and second electrostatic protecting circuits 5a and 5b. The protrusions produce spaces for the electrostatic protecting circuits. Beneficially, the signal lines that leave the driving circuit 1 and that enter the LCD array 2 are evenly spaced.

[0033] Fig. 5 is a schematic view of an LCD having electrostatic protecting circuits that is in accord with a fourth embodiment of the present invention. As shown in Fig. 5, parallel first and second common electrodes 4a and 4b are arranged between a driving circuit 1 and an LCD array 2. Furthermore, a plurality of sets of adjacent signal lines 3a and 3b, which can be data lines and/or gate lines, extend from the driving circuit 1 to the LCD array 2. Still referring to Fig. 5, electrostatic protecting circuits 5 are alternately located on both sides of the first and second common electrodes 4a and 4b and between sets of signal lines 3a and 3b. That is, for a first set of signal lines 3a and 3b, electrostatic protecting circuits are located on each side of the common electrode 4a, while within the neighboring set of signal lines 3a and 3b the electrostatic protecting circuits are arranged on each side of the common electrode 4b, and so on. In both cases, an electrostatic protecting circuit connects between the signal line 3a and the centering common electrode, and another electrostatic protecting circuit connects between the signal line 3b and the centering common electrode. Still referring to Fig. 5, the

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signals lines 3a and 3b can have protrusions, which may be beveled or curved, to provide spaces between the signals lines 3a and 3b for the electrostatic protecting circuits 5. Furthermore, as shown, the electrostatic protecting circuits connected to the first common electrode 4a are not aligned with the electrostatic protecting circuits connected to the second common electrode 4b. Beneficially, the signal lines that leave the driving circuit 1 and that enter the LCD array 2 are evenly spaced.

[0034] Fig. 6 is a schematic view of an LCD having electrostatic protecting circuits that is in accord with a fifth embodiment of the present invention. As shown in Fig. 6, parallel first, second, third and fourth common electrodes 4a, 4b, 4c and 4d are arranged between a driving circuit 1 and an LCD array 2. Additionally, a plurality of sets of signal lines 3a and 3b, which may be data lines and/or gate lines, extend between the driving circuit 1 and the LCD array 2. As shown, the first common electrode 4a is adjacent to the second common electrode 4b, the third common electrode 4c is adjacent to the fourth common electrode 4d, and the first and second common electrodes are relatively widely spaced from the third and fourth common electrodes.

[0035] Between the signal lines 3a and 3b of each set is a pair of electrostatic protecting circuits 5. Those electrostatic protecting circuits are arranged on opposite sides of the adjacent common electrodes. That is and as shown, electrostatic protecting circuits 5 are arranged on opposite sides of the first and second common electrodes 4a and 4b, or on the opposite sides of the third and fourth common electrodes 4c and 4d. Still referring to Fig. 6, the signal lines 3a and 3b of a set may include protrusions, which may be beveled or curved, that form a

spaces for the electrostatic protecting circuits. Beneficially, the signal lines that leave the driving circuit 1 and that enter the LCD array 2 are evenly spaced.

[0036] An LCD according to the present invention has significant advantages. Since the electrostatic protecting circuits are arranged on both sides of one or more common electrodes, or by protrusions of the signal lines, the electrostatic protecting circuits can be positioned and aligned such that only a narrow space between signal lines is required. This enables electrostatic protection in high resolution LCDs.

[0037] The foregoing embodiments are merely exemplary and are not to be construed as limiting the present invention. The present teachings can be readily applied to other types of apparatuses. The description of the present invention is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art.

**What is claimed is:**

1. An LCD comprising:

a plurality of signal lines formed at constant intervals;

a common electrode arranged in a vertical direction to the signal lines;

a plurality of first electrostatic protecting circuits arranged at one side of the common electrode between adjacent first and second signal lines in pairs to be connected with the first signal lines of the respective pairs and the common electrode; and

a plurality of second electrostatic protecting circuits arranged at the other side of the common electrode to be connected with the second signal lines of the respective pairs and the common electrode.

2. The LCD of claim 1, wherein the common electrode includes two first and second lines, the first line being connected with the first electrostatic protecting circuit and the second line being connected with the second electrostatic protecting circuit.

3. The LCD of claim 2, wherein the first and second electrostatic protecting circuits are arranged at both sides around the first and second lines.

4. An LCD comprising:

a plurality of signal lines formed at constant intervals;

a common electrode arranged in a vertical direction to the signal lines;

a plurality of first electrostatic protecting circuits connected with odd numbered signal lines and the common electrode at one side of the common electrode; and

a plurality of second electrostatic protecting circuits connected with even numbered signal lines and the common electrode at the other side of the common electrode.

5. The LCD of claim 4, wherein ~~{the odd numbered signal lines and the even numbered signal lines are curved in their crossing portions}~~ **[each of the signal lines includes protrusions for the first and second electrostatic protecting circuits]**.

6. An LCD comprising:

a plurality of signal lines formed at constant intervals;

first and second common electrodes arranged at constant intervals in a vertical direction to the signal lines;

a plurality of first and second electrostatic protecting circuits arranged at both sides of the first common electrode between first and second signal lines of odd numbered pairs in adjacent first and second signal lines in pairs to be respectively connected with a pair of the first signal line and the first common electrode and a pair of the second signal line and the first common electrode; and

a plurality of third and fourth electrostatic protecting circuits arranged at both sides of the second common electrode between the first and second signal lines of even numbered pairs to be respectively connected with a pair of the first signal line and the second common electrode and a pair of the second signal line and the second common electrode.

7. The LCD of claim 6, wherein the first and second electrostatic protecting circuits are arranged to cross the third and fourth electrostatic protecting circuits.

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8. The LCD of claim 6, wherein the respective signal lines are curved in portions where a pair of the first and second electrostatic protecting circuits and a pair of the third and fourth electrostatic protecting circuits are arranged.

9. The LCD of claim 6, wherein the first common electrode includes two first and second lines, the first line being connected with the respective first electrostatic protecting circuit and the second line being connected with the respective second electrostatic protecting circuit.

10. The LCD of claim 6, wherein the second common electrode includes two first and second lines, the first line being connected with the respective third electrostatic protecting circuit and the second line being connected with the respective fourth electrostatic protecting circuit.

**[11. An LCD comprising:**

**a plurality of pairs of signal lines;**

**a common electrode that extends perpendicular to the pairs of signal lines;**

**a plurality of first electrostatic protecting circuits arranged on one side of said common electrode, each of said first electrostatic protecting circuits positioned between a corresponding pair of signal lines, and wherein each of said first electrostatic protecting circuits is connected between a first signal line of its corresponding pair and the common electrode; and**

**a plurality of second electrostatic protecting circuits arranged on an opposite side of the common electrode, wherein each of said second electrostatic protecting circuits is positioned between a corresponding pair of signal lines, and wherein each**



of said second electrostatic protecting circuits is connected between a second signal line of its corresponding pair and the common electrode.

12. The LCD of claim 11, wherein said common electrode includes a first line and a second line, wherein said first electrostatic protecting circuits connect to said first line, and wherein said second electrostatic protecting circuits connect to said second line.

13. The LCD of claim 12, wherein said first and second electrostatic protecting circuits are respectively arranged on opposite sides of the first and second lines.

14. The LCD of claim 11, wherein said pairs of signal lines are equally spaced.

15. The LCD of claim 11, wherein said signal lines are straight.

16. The LCD of claim 11, wherein said signal lines include protrusions.

17. The LCD of claim 16, wherein said protrusions are beveled.

18. The LCD of claim 11, further including driving circuitry and an LCD array, wherein said signal lines extend between said driving circuitry and said LCD array.

19. An LCD comprising:

a plurality of signal lines having odd numbered signal lines and even numbered signal lines;

a common electrode that extends perpendicular to said signal lines;

a plurality of first electrostatic protecting circuits on one side of the common electrode, wherein each of said first electrostatic protecting circuits connects between each of odd numbered signal line and the common electrode; and

a plurality of second electrostatic protecting circuits on an opposite side of the common electrode, wherein each of said second electrostatic protecting circuits connects between each of even numbered signal lines and the common electrode.

20. The LCD of claim 19, wherein said pairs of signal lines are equally spaced.

21. The LCD of claim 19, wherein said signal lines include protrusions.

22. The LCD of claim 21, wherein said protrusions are beveled.

23. The LCD of claim 19, further including driving circuitry and an LCD array, wherein said signal lines extend between said driving circuitry and said LCD array.

24. An LCD comprising:

a plurality of pairs of signal lines;

first and second common electrodes that extend perpendicular to said signal lines;

a plurality of pairs of first electrostatic protecting circuits, wherein each pair of said first electrostatic protecting circuits is arranged between a corresponding pair of signal lines, wherein the first electrostatic protecting circuits of each pair are

arranged on opposite sides of the first common electrode, wherein one of the first electrostatic protecting circuits of each pair connects to one of the signal lines of the corresponding pair of signal lines, and wherein the other first electrostatic protecting circuit of each pair connects to the other signal line of the corresponding pair of signal lines; and

a plurality of pairs of second electrostatic protecting circuits, wherein each pair of said second electrostatic protecting circuits is arranged between a corresponding pair of signal lines, wherein the second electrostatic protecting circuits of a pair are arranged on opposite sides of the second common electrode, wherein one of the second electrostatic protecting circuits of a pair connects to one of the signal lines of the corresponding pair, and wherein the other second electrostatic protecting circuit of a pair connects to the other signal line of the corresponding pair.

25. The LCD of claim 24, wherein said pairs of first and second electrostatic protecting circuits are alternately arranged.

26. The LCD of claim 24, wherein said signal lines include protrusions.

27. The LCD of claim 27, wherein said protrusions are beveled.

28. The LCD of claim 24, wherein said first common electrode includes first and second lines, wherein one of the first electrostatic protecting circuits of a pair connects to said first line, and wherein the other first electrostatic protecting circuit of a pair connects to said second line.

**29. The LCD of claim 24, further including driving circuitry and an LCD array, wherein said signal lines extend between said driving circuitry and said LCD array.**

**30. The LCD of claim 19, wherein the first and second electrostatic protecting circuits are respectively arranged on opposite sides of the odd or even numbered signal line.]**

**ABSTRACT OF THE DISCLOSURE**

An LCD ~~{provided with an}~~ [having] electrostatic protecting ~~{circuit includes}~~ [circuits arranged to enable closely spaced signal lines and electrostatic protection in high resolution LCDs. A common electrode crosses] a plurality of signal lines ~~{formed at constant intervals, a common electrode arranged in a vertical direction to the signal lines, a plurality of first}~~ [that extend from a driving circuit to an LCD array. A plurality of ]electrostatic protecting circuits ~~{respectively}~~ [are] arranged ~~{at one}~~ [on each] side of the common electrode ~~{between adjacent first and second signal lines in pairs to be connected with the first signal lines of the respective pairs and the common electrode, and a plurality of second}~~ [and between adjacent signal lines. The signal lines can be beveled or curved to provide space of the ]electrostatic protecting circuits ~~{arranged at the other side of the common electrode to be connected with the second signal lines of the respective pairs and the common electrode. Thus, a narrow space of the signal lines can efficiently be used and the LCD of high resolution can be obtained}~~]. Furthermore, multiple common electrodes can be incorporated, enabling electrostatic protecting circuits to be connected between the signal lines and the various common electrodes].

## ----- REVISION LIST -----

The bracketed numbers refer to the Page and Paragraph for the start of the paragraph in both the old and the new documents.

- [1:2 1:2] Add Paras "Cross Reference ... incorporated by reference."
- [1:4 1:6] Changed "The present " to "[0002] This "
- [1:4 1:6] Changed "to a liquid" to "to liquid"
- [1:4 1:6] Changed "display " to "displays "
- [1:4 1:6] Changed "in which " to "having "
- [1:4 1:6] Changed "protecting ... line interval" to "protection circuit"
- [1:6 1:8] Changed "Generally, an LCD " to "[0003] Generally, ... device that "
- [1:6 1:8] Changed "and a driving circuit.  
" to "and driving circuitry.  
[0004]"
- [1:7 1:9] Changed "panel includes" to "panel itself includes"
- [1:7 1:9] Changed "substrates, and a" to "substrates ... interposed"
- [1:7 1:9] Changed "layer in which ... substrates. " to "layer"
- [1:8 1:9] Changed "A common " to ". On the upper ... a system "
- [1:8 1:9] Changed "are formed ... arranged on " to ". On "
- [1:8 1:9] Changed "in one direction ... points of " to "are a plurality ... points where  
"
- [1:8 1:9] Changed "data lines. In" to "data lines cross. "
- [1:8 1:10] Changed ". In the LCD ... respective " to "[0005] Within ... crossing "
- [1:8 1:10] Changed "transistor are" to "transistor (TFT) are"
- [1:8 1:10] Changed "region. A ... connected" to "region. The ... electrodes connects"
- [1:8 1:10] Changed "lines, a source ... connected" to "lines, the ... electrodes  
connect"
- [1:8 1:10] Changed "a pixel electrode ... transistor is " to "the TFT drain ...  
transistors are "
- [1:8 1:10] Changed "in accordance with a signal " to "by gate signals "
- [1:8 1:10] Changed "Thus, a data ... circuit. " to "Furthermore, ... desired image. "
- [1:9 1:11] Changed "In the aforementioned ... damaged if the " to "[0006] Often, ...  
When this "
- [1:9 1:11] Changed "gate lines ... data lines. " to "gate "
- [1:10 1:11] Changed "To protect ... is formed " to "or data lines ... inserted "
- [1:10 1:11] Changed "circuit and ... lines, and an " to "circuitry ... lines. Then, "
- [1:10 1:11] Changed "circuit is ... portion of the " to "circuits, ... gate and/or "
- [1:10 1:11] Changed "electrode ... lines and " to "electrodes. ... potential of "
- [1:10 1:11] Changed "electrode. " to "electrode "
- [1:11 1:11] Changed "If the electrostatic ... lines and the " to "is applied ... gate and/or  
"
- [1:11 1:11] Changed "circuit. Accordingly, ... is applied" to "circuit as ... electricity  
applied"
- [1:11 1:11] Changed "or the" to "or to the"

[1:11 1:11] Changed "lines," to "lines does ... no damage. "  
 [1:11 1:12] Changed ", it does ... " to "[0007] "  
 [1:12 1:12] Changed "provided with the aforementioned " to "having an "  
 [1:12 1:12] Changed "the accompanying drawings." to "the "  
 [1:13 1:12] Changed "Fig. 1 is ... protecting circuit" to "schematic view of Fig. 1"  
 [1:14 1:12] Changed "LCD, since ... greater than the" to "LCD the"  
 [1:14 1:12] Changed "circuit, the ... circuit is " to "circuits are "  
 [1:15 1:12] Changed "As shown in ... state that a " to "A "  
 [1:15 1:12] Changed "4 is arranged between" to "4 extends between"  
 [1:15 1:12] Changed "in a vertical ... data lines 3 " to "and perpendicular to the data "  
 [1:15 1:12] Changed ", an " to "3. An "  
 [1:15 1:12] Changed "arranged in ... portions " to "located near each crossing "  
 [1:15 1:12] Changed "the data lines 3. " to "the "  
 [1:16 1:12] Changed "The respective ... is formed " to "lines 3. Further, ... 3 extends "  
 [1:17 1:13] Changed "However" to "[0008] While ... successful"  
 [1:17 1:13] Changed "provided with " to "shown in Fig. ... problem. Since "  
 [1:17 1:13] Changed "protecting ... problems. " to "protecting "  
 [1:18 1:13] Changed "Since " to "circuits are ... physically locate "  
 [1:18 1:13] Changed "circuit is ... to arrange " to "circuits 5 ... LCDs, or if "  
 [1:18 1:13] Changed "circuit if ... than the " to "circuits are ... incorporating "  
 [1:18 1:13] Changed "protecting circuit. " to "protecting "  
 [1:19 1:13] Changed "In other words, ... protecting circuit" to "circuits would be beneficial"  
 [1:21 1:15] Changed "Accordingly," to "[0009] Accordingly,"  
 [1:22 1:16] Changed "An" to "[0010] An"  
 [1:22 1:16] Changed "position " to "locations "  
 [1:22 1:16] Changed "of an electrostatic protecting circuit" to "of the electrostatic ... signal lines."  
 [1:22 1:16] Changed "protecting ... resolution. " to "protecting "  
 [1:22 1:17] Add Paras "[0011] Another ... small pixels. "  
 [1:22 1:21] Changed "protecting circuit" to "[0015] Additional"  
 [1:23 1:21] Changed "description which " to "descriptions that "  
 [1:23 1:21] Changed "from the description," to "from those descriptions,"  
 [1:23 1:21] Changed "hereof as" to "hereof, as"  
 [1:23 1:21] Changed "as the" to "as shown in the"  
 [1:24 1:22] Changed "To" to "[0016] To"  
 [1:24 1:22] Changed "accordance " to "accord "  
 [1:24 1:22] Changed "with the purpose" to "with a purpose"  
 [1:24 1:22] Changed "lines formed ... intervals," to "lines,"  
 [1:24 1:22] Changed "arranged in ... direction " to "that extends ... perpendicular "  
 [1:24 1:22] Changed "respectively arranged at one" to "respectively located on one"  
 [1:24 1:22] Changed "between adjacent ... electrode" to "and between ... signal lines"  
 [1:24 1:22] Changed "arranged at the" to "arranged on the"  
 [1:24 1:22] Changed "to be connected ... pairs and " to "and between ... connects between "  
 [1:24 1:22] Changed "electrode." to "electrode ... signal lines. "

- [1:24 1:23] Changed ".  
" to "[0017] "
- [1:25 1:23] Changed "lines formed ... intervals," to "lines,"
- [1:25 1:23] Changed "at constant ... direction " to "perpendicular "
- [1:25 1:23] Changed "lines, a" to "lines and ... array, and a"
- [1:25 1:23] Changed "of first and ... electrostatic" to "of electrostatic"
- [1:25 1:23] Changed "at both sides ... and fourth " to "on opposite ... enable the "
- [1:25 1:23] Changed "arranged at ... the second " to "to be located ... adjacent a first "
- [1:25 1:23] Changed "electrode ... the second" to "electrode ... the second"
- [1:26 1:24] Changed "To" to "[0018] To"
- [1:26 1:24] Changed "includes a plurality of" to "includes sets of pairs of"
- [1:26 1:24] Changed "formed at ... intervals, a " to ", first and second "
- [1:26 1:24] Changed "common electrode ... direction" to "common electrodes ... perpendicular"
- [1:26 1:24] Changed "lines, a" to "lines and ... array, and a"
- [1:26 1:24] Changed "of first electrostatic" to "of electrostatic"
- [1:26 1:24] Changed "connected ... of second " to ". The "
- [1:26 1:24] Changed "connected ... and second " to "are alternatingly ... enable the "
- [1:26 1:24] Changed "circuits are" to "circuits to ... of a set. "
- [1:26 1:25] Changed "are curved.  
" to "[0019] "
- [1:27 1:25] Changed "explanatory and" to "explanatory only and"
- [1:29 1:27] Changed "The" to "[0020] The"
- [1:30 1:28] Changed "Fig." to "[0021] Fig."
- [1:30 1:28] Changed "provided with an " to "having "
- [1:30 1:28] Changed "protecting circuit;" to "protecting circuits; "
- [1:30 1:29] Changed "circuit;  
" to "[0022] "
- [1:31 1:29] Changed "provided with an " to "having "
- [1:31 1:29] Changed "circuit according to the " to "circuits that ... accord with a "
- [1:32 1:30] Changed "Fig." to "[0023] Fig."
- [1:32 1:30] Changed "provided with an " to "having "
- [1:32 1:30] Changed "circuit according to the " to "circuits that ... accord with a "
- [1:33 1:31] Changed "Fig." to "[0024] Fig."
- [1:33 1:31] Changed "provided with an " to "having "
- [1:33 1:31] Changed "circuit according to the " to "circuits that ... accord with a "
- [1:34 1:32] Changed "Fig." to "[0025] Fig."
- [1:34 1:32] Changed "provided with an " to "having "
- [1:34 1:32] Changed "circuit according to the " to "circuits that ... accord with a "
- [1:35 1:33] Changed "Fig." to "[0026] Fig."
- [1:35 1:33] Changed "provided with an " to "having "
- [1:35 1:33] Changed "circuit according to the " to "circuits that ... accord with a "
- [1:36 1:34] Changed "PREFERRED " to "ILLUSTRATED "
- [1:37 1:35] Changed "Reference" to "[0027] Reference"
- [1:37 1:35] Changed "preferred " to "illustrated "
- [1:37 1:35] Changed "illustrated " to "shown "



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- [1:38 1:36] Del Paras "Fig. 2 is a schematic ... can be obtained. "  
[1:56 1:36] Add Paras "[0028] Fig. 2 is ... resolution LCDs. "  
[1:56 1:45] Changed "The foregoing" to "[0037] The foregoing"  
[2:14 2:14] Changed "the odd numbered ... crossing portions" to "each of the ...  
protecting circuits"  
[3:1 2:24] Add Paras "11. An LCD comprising: ... numbered signal line."  
[3:2 3:2] Changed "provided with an " to "having "  
[3:2 3:2] Changed "circuit includes " to "circuits arranged ... electrode crosses "  
[3:2 3:2] Changed "formed at ... of first " to "that extend ... plurality of "  
[3:2 3:2] Changed "respectively " to "are "  
[3:2 3:2] Changed "at one " to "on each "  
[3:2 3:2] Changed "between adjacent ... of second " to "and between ... space of the  
"  
[3:2 3:2] Changed "arranged at ... be obtained" to ". Furthermore, ... electrodes"